



July 2017

NUCLEAR WEAPONS SUSTAINMENT

Budget Estimates
Report Contains More
Information than in
Prior Fiscal Years, but
Transparency Can Be
Improved

GAO Highlights

Highlights of [GAO-17-557](#), a report to congressional committees

Why GAO Did This Study

DOD and DOE are undertaking an extensive effort to sustain and modernize aging U.S. nuclear weapons capabilities. This effort is expected to take decades and cost hundreds of billions of dollars. Section 1043 of the National Defense Authorization Act for Fiscal Year 2012, as amended, requires submission of an annual report to congressional committees on DOD's and DOE's plans for related matters and includes a provision that GAO review aspects of that joint report. GAO has previously recommended that future joint reports provide more thorough documentation of methodologies and context for significant changes from year to year.

GAO assessed the extent to which the fiscal year 2017 joint report provides (1) budget estimates that are consistent with the departments' internal funding and modernization plans and (2) complete and transparent information on the methodology used to develop the estimates. GAO analyzed the departments' internal plans and budget estimates for sustaining and modernizing the nuclear deterrent and interviewed DOD and DOE officials.

What GAO Recommends

GAO recommends that DOD (1) improve the completeness and transparency of future joint reports, for example by explaining how it selects NC3 program elements, and (2) provide additional context in the report to identify any significant changes to the Air Force's estimates from the prior year and the reasons for such changes. DOD agreed with GAO's recommendations. GAO did not make any new recommendations to DOE.

View [GAO-17-557](#). For more information, contact Joe Kirschbaum at (202) 512-9971 or kirschbaumj@gao.gov or David Trimble at (202) 512-3841 or trimbled@gao.gov.

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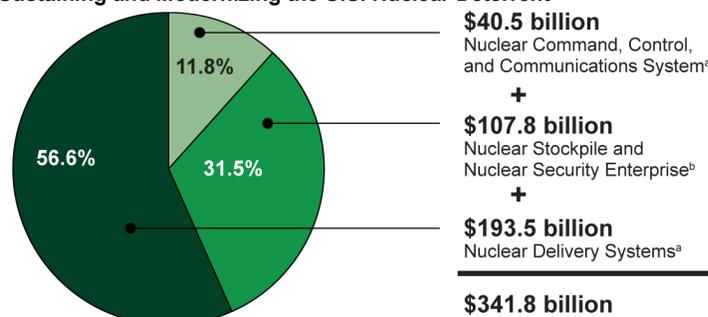
NUCLEAR WEAPONS SUSTAINMENT

Budget Estimates Report Contains More Information than in Prior Fiscal Years, but Transparency Can Be Improved

What GAO Found

The fiscal year 2017 joint report submitted by the Department of Defense (DOD) and the Department of Energy (DOE) in August 2016 includes 10-year budget estimates for sustaining and modernizing U.S. nuclear weapons (see figure below), and these estimates are generally consistent with the two departments' internal funding and modernization plans—with some exceptions. GAO could not verify that DOD's nuclear command, control, and communications (NC3) estimates were fully consistent with its internal funding plans. GAO also identified concerns about the alignment of DOE's modernization funding needs with potential future budgets; GAO recently recommended in a separate report that DOE address these concerns.

Departments of Defense (DOD) and Energy (DOE) Fiscal Year 2017 10-Year Estimates for Sustaining and Modernizing the U.S. Nuclear Deterrent



Source: GAO analysis of Department of Defense (DOD) and Department of Energy (DOE) data. | GAO-17-557

^aDOD provides budget estimates for the nuclear command, control, and communications system and for delivery systems.

^bDOE provides budget estimates for the nuclear weapons stockpile and the nuclear security enterprise.

The fiscal year 2017 joint report generally includes more information than the fiscal year 2016 joint report did, but it continues to omit explicit information about all assumptions and limitations in DOD's and DOE's methodologies and reasons for year-to-year programmatic changes in some estimates—information that could improve transparency for decision makers in Congress. For example, DOD's NC3 estimate methodology does not describe how it selects program elements, determines its weighted analysis ratios, or differentiates methodologies for some funding streams. Additionally, DOD's methodology does not fully explain programmatic changes with Air Force line items or the effect these changes may have on the joint report's year-to-year comparisons. Unless the report includes thorough documentation of the methodologies used and identifies significant changes from prior years, it may be difficult for Congress to understand the basis for the estimates or assess long-term affordability when allocating resources. The joint report leaves out certain components of the methodology by which DOE's estimates are developed; however, DOE provides further information in other sources, including the annual *Stockpile Stewardship and Management Plan*.

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Abbreviations

CBO	Congressional Budget Office
DOD	Department of Defense
DOD CIO	DOD Chief Information Officer
DOE	Department of Energy
FYDP	Future Years Defense Program
FYNSP	Future Years Nuclear Security Program
ICBM	intercontinental ballistic missile
OMB	Office of Management and Budget
NC3	nuclear command, control, and communications
NNSA	National Nuclear Security Administration

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July 20, 2017

Congressional Committees

The Department of Defense (DOD) and the Department of Energy (DOE) are undertaking an extensive, multifaceted effort to sustain and modernize U.S. nuclear weapons capabilities, including the nuclear weapons stockpile; the research and production infrastructure; delivery systems; and the nuclear command, control, and communications (NC3) system.¹ The strategic missiles, submarines, and aircraft—and the nuclear weapons carried by these delivery systems—are aging and being deployed beyond their intended service lives. Many of the National Nuclear Security Administration’s (NNSA)² key facilities for nuclear weapons research, development, and production date back to the 1940s and 1950s and, according to the 2010 *Nuclear Posture Review Report*, require modernization to ensure a safe, secure, and effective nuclear arsenal for as long as such weapons exist.³ DOD and DOE estimates project that sustainment and modernization efforts will cost billions of dollars over the next decade.

Section 1043 of the National Defense Authorization Act for Fiscal Year 2012, as amended, requires the President, in consultation with the Secretary of Defense and the Secretary of Energy, to submit a report on the plan for the nuclear weapons stockpile, complex,⁴ delivery systems,

¹The nuclear weapons stockpile consists of seven weapon types. Nuclear delivery systems consist of a variety of platforms—including heavy bombers, air-launched cruise missiles, and ballistic missile submarines—operated by the Air Force and the Navy. The NC3 system consists of satellites, early warning radars, aircraft, communications networks, and other systems that are managed by the Air Force, the Navy, the Defense Information Systems Agency, and other organizations.

²NNSA is a separately organized agency within DOE that is responsible for the management and security of DOE’s nuclear weapons, nuclear nonproliferation, and naval reactor programs.

³Department of Defense, *Nuclear Posture Review Report* (Washington, D.C.: Apr. 6, 2010).

⁴Except when referencing the statutory requirement, this report hereafter refers to the “nuclear weapons complex” as the “nuclear security enterprise,” which consists of eight geographically dispersed government-owned, contractor-operated sites, such as laboratories and production plants. Collectively, the nuclear weapons stockpile, platforms, and delivery systems; NC3; and the nuclear security enterprise are considered the U.S. nuclear deterrent.

and command and control system for each of fiscal years 2013 through 2019.⁵ DOD and DOE develop this annual report, which we refer to as the joint report.⁶ This joint report is to include nuclear sustainment and modernization plans as well as associated budget estimates for the 10 years following the date of the report,⁷ and must also include a detailed description of the costs included in the budget estimates and the methodology used to develop the estimates.⁸

The National Defense Authorization Act for Fiscal Year 2013 included a provision that we review each joint report for accuracy and completeness with respect to the budget estimates and the methodologies that were used to develop the estimates.⁹ We most recently reported on the fiscal year 2016 joint report in December 2015.¹⁰ On August 5, 2016, DOD and DOE submitted to Congress their fiscal year 2017 joint report. This report assesses the extent to which the joint report provides (1) budget estimates for nuclear sustainment and modernization that are consistent with DOD's and DOE's internal funding plans and long-term nuclear modernization plans and (2) complete and transparent information about the development of the nuclear sustainment and modernization budget estimates.

We performed our work at the Office of the Secretary of Defense, the Secretary of the Navy, the Secretary of the Air Force, and the DOD Chief Information Officer (DOD CIO), and at NNSA. To address our objectives,

⁵See Pub. L. No. 112-81, § 1043(a) (2011), *amended by the* National Defense Authorization Act for Fiscal Year 2013, Pub. L. No. 112-239, § 1041 (2013) *and* National Defense Authorization Act for Fiscal Year 2014, Pub. L. No. 113-66, § 1054 (2013). The report is to be transmitted to the congressional defense committees, the Senate Committee on Foreign Relations, and the House Committee on Foreign Affairs. § 1043(a)(1). The President has delegated this reporting function to the Secretary of Defense and Secretary of Energy. See 77 Fed. Reg. 12,721 (Mar. 2, 2012).

⁶DOD and DOE, *Fiscal Year 2017 Report on the Plan for the Nuclear Weapons Stockpile, Nuclear Weapons Complex, Nuclear Weapons Delivery Systems, and Nuclear Weapons Command and Control System Specified in Section 1043 of the National Defense Authorization Act for Fiscal Year 2012* (Washington, D.C.: Aug. 5, 2016).

⁷See § 1043(a)(2).

⁸See § 1043(a)(3).

⁹See Pub. L. No. 112-239, § 1041(a)(2) (adding § 1043(c)).

¹⁰GAO, *Nuclear Weapons Sustainment: Improvements Made to Budget Estimates Report, but Opportunities Remain to Further Enhance Transparency*, GAO-16-23 (Washington, D.C.: Dec. 10, 2015).

we followed a methodology similar to the one we used during our review of the prior fiscal years' joint reports. Specifically, we examined the departments' plans and budget estimates for sustaining and modernizing the nuclear deterrent in three areas: (1) DOD nuclear delivery systems, (2) the DOD NC3 system, and (3) the DOE nuclear security enterprise. We applied the approach described below:

First, to determine the extent to which the budget estimates in the 2017 joint report are consistent (accurate and complete) with DOD's and DOE's internal funding and long-term modernization plans, we obtained and analyzed the plans and estimates from the 2017 joint report and compared them with each department's funding plans, including DOD's Future Years Defense Program (FYDP) and DOE's Future Years Nuclear Security Program (FYNSP). We compared DOD's and DOE's estimates in the joint report with the FYDP and the FYNSP, because these are used by the two departments to formulate projected budget requests for the current year and at least 4 subsequent years. In this report, we refer to the FYDP and FYNSP as "internal funding plans." Because DOD has not prepared formal funding plans that it will use to develop projected defense budget requests beyond fiscal year 2021, and the 2017 joint report includes budget estimates through fiscal year 2026, we reviewed Air Force and Navy plans as well as Defense Information Systems Agency plans, which informed the DOD CIO's NC3 estimates; we also discussed DOD's long-term budget estimates in the joint report with relevant DOD officials. If the budget estimates in the 2017 joint report were consistent with the departments' funding plans, including the FYDP and FYNSP, we determined them to be sufficiently accurate and complete. To assess budget estimates beyond fiscal year 2021 for DOE, we evaluated DOE's *Stockpile Stewardship and Management Plan*, which is updated annually and includes DOE's budget estimates for nuclear weapons sustainment and modernization for the next 25 years.¹¹

Second, to assess the extent to which the 2017 joint report included complete and transparent information about the methodology DOD and

¹¹The *Stockpile Stewardship and Management Plan* is NNSA's formal means for communicating to Congress the status of certain activities and its long-range plans and budget estimates for sustaining the stockpile and modernizing the nuclear security enterprise. The Ike Skelton National Defense Authorization Act for Fiscal Year 2011 mandated that GAO study and report annually on whether NNSA's nuclear security budget materials provide for funding that is sufficient to modernize and refurbish the nuclear security enterprise. Pub. L. No. 111-383, § 3113 (2011) (codified as amended at 50 U.S.C. § 2455).

DOE used to develop their budget estimates for nuclear sustainment and modernization, we drew on the work we had performed for our review of the prior fiscal years' joint reports.¹² Additionally, we discussed with relevant officials whether the guidance and methodologies DOD and DOE used to prepare their 10-year estimates for the 2017 joint report were the same as those they had used for the fiscal year 2016 joint report. In instances where different methodologies were used, we discussed the reasons why with cognizant officials. For our 2014 report, we derived general principles for developing and preparing long-term funding plans by reviewing key federal and departmental guidance, standards, and practices for cost estimating, budget preparation, financial planning, and public reporting.¹³ We applied these derived principles as criteria for evaluating the information in the 2017 joint report. To the extent that we determined there were differences between the principles we derived and the information in the 2017 joint report, we discussed the causes and potential effects of these differences with relevant DOD and DOE officials.

We conducted this performance audit from May 2016 to July 2017 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. Appendix I provides more details on our scope and methodology.

¹²GAO, *Nuclear Weapons: Ten-Year Budget Estimates for Modernization Omit Key Efforts, and Assumptions and Limitations Are Not Fully Transparent*, GAO-14-373 (Washington, D.C.: June 10, 2014); *Nuclear Weapons Sustainment: Improvements Made to Budget Estimates, but Opportunities Exist to Further Enhance Transparency*, GAO-15-536 (Washington, D.C.: July 30, 2015); and GAO-16-23.

¹³GAO-14-373. Such federal guidance included the following: Executive Office of the President, Office of Management and Budget, *Preparation, Submission, and Execution of the Budget*, Circular No. A-11 (Washington, D.C.: July 2013); V 3.0 *Capital Programming Guide: Supplement to Circular No. A-11: Planning, Budgeting, and Acquisition of Capital Assets* (Washington, D.C.: July 2013); and *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies*, accessed August 14, 2013, http://www.whitehouse.gov/omb/fedreg_final_information_quality_guidelines; and GAO, *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*, GAO-09-3SP (Washington, D.C.: Mar. 2, 2009).

Background

Statutory Requirements for DOD and DOE to Report on Nuclear Posture and Estimates

The 2010 *Nuclear Posture Review Report*, which was statutorily required, outlined the administration's approach to maintaining the U.S. nuclear deterrent capability while showing its intent to make new investments in developing strategic delivery systems, upgrading the NC3 system, and modernizing NNSA's government-owned, contractor-operated nuclear security enterprise.¹⁴ It identified long-term modernization goals and plans—including sustaining a safe, secure, and effective nuclear arsenal by extending the lives of existing nuclear weapons; increasing investments to rebuild and modernize the nation's nuclear infrastructure; and strengthening the science, technology, and engineering base.¹⁵

Section 1043 of the National Defense Authorization Act for Fiscal Year 2012, as amended, requires that the annual joint report include 10-year budget estimates related to sustaining and modernizing U.S. nuclear weapons capabilities, among several other elements.¹⁶ The other required elements include detailed descriptions of DOD's and DOE's plans to

- enhance the safety, security, and reliability of the U.S. nuclear weapons stockpile;
- sustain and modernize the nuclear weapons complex;

¹⁴Section 1070 of the National Defense Authorization Act for Fiscal Year 2008, Pub. L. No. 110-181 (2008), required the Secretary of Defense, in consultation with the Secretary of Energy and Secretary of State, to conduct a comprehensive review of the nuclear posture of the United States for the next 5 to 10 years. DOD published the conclusions and recommendations from that review in the April 2010 *Nuclear Posture Review Report*. Department of Defense, *Nuclear Posture Review Report*.

¹⁵Ibid.

¹⁶See Pub. L. No. 112-81, § 1043(a)(2) (as amended). Specifically, section 1043 requires that the joint report include a detailed estimate of the budget requirements associated with sustaining and modernizing the U.S. nuclear deterrent and nuclear weapons stockpile, including the costs associated with various plans, over the 10-year period following the date of the report. § 1043(a)(2)(F). The budget requirements are to include applicable and appropriate costs associated with DOD's procurement; military construction; operation and maintenance; and research, development, test, and evaluation accounts. *Id.* The joint report is also to include a detailed description of costs included in the budget estimates and the methodology used to develop the estimates. § 1043(a)(3).

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- maintain, modernize, and replace delivery systems for nuclear weapons;
 - sustain and modernize the nuclear weapons command and control system; and
 - retire, dismantle, or eliminate any nuclear weapons, delivery systems, or silos/submarines that carry such weapons or delivery systems.¹⁷

Section 1043 was amended by the Carl Levin and Howard P. “Buck” McKeon National Defense Authorization Act for Fiscal Year 2015 to require the Congressional Budget Office (CBO) to submit to the congressional defense committees a related report for odd-numbered fiscal years, to include estimates of certain costs for nuclear weapons and delivery systems.¹⁸ The CBO report is to include an estimate of costs during a 10-year period associated with fielding and maintaining the current U.S. nuclear weapons and nuclear weapon delivery systems; an estimate of the costs during a 10-year period of any anticipated life extension, modernization, or replacement of those nuclear weapons and delivery systems; and an estimate of the relative percentage of total defense spending represented by these costs during that period.¹⁹ CBO’s February 2017 estimate of costs for the fiscal year 2017 through 2026 time frame is \$400 billion—15 percent higher than its January 2015 estimate of the 10-year costs of nuclear forces, which was \$348 billion over the 2015–2024 period.

DOD and DOE Funding Plans to Sustain and Modernize U.S. Nuclear Capabilities

The FYDP is DOD’s 5-year funding plan; it is updated annually and provides DOD’s current budget request and budget estimates for at least 4 subsequent fiscal years. The FYDP includes thousands of discrete program elements, each of which may include funding projections for DOD appropriations accounts—including operation and maintenance;

¹⁷§ 1043(a)(2). The report must also include a detailed description of the steps taken to implement the plan submitted in the previous year, including difficulties encountered in implementation. § 1043(a)(2)(G).

¹⁸See Carl Levin and Howard P. “Buck” McKeon National Defense Authorization Act for Fiscal Year 2015, Pub. L. No. 113-291, § 1643 (2014) (amending § 1043(b)). If the joint report submitted for an even-numbered fiscal year contains a significant change affecting the estimates that the CBO included in the prior year’s report, the CBO must submit a letter describing the changes. See § 1043(b)(2) (as amended).

¹⁹The CBO submitted its latest report on projected costs of U.S. nuclear forces in February 2017. See Congressional Budget Office, *Projected Costs of U.S. Nuclear Forces, 2017 to 2026* (Washington, D.C.: February 2017).

research, development, test, and evaluation; and procurement. DOD's Director of Cost Assessment and Program Evaluation maintains the FYDP and works with the Office of the Under Secretary of Defense (Comptroller) to ensure that the data presented in annual budget-justification materials match the FYDP at the appropriation account level.

The FYNSP is NNSA's 5-year funding plan, encompassing programs for which NNSA is responsible, including Weapons Activities, Defense Nuclear Nonproliferation, and Naval Reactors. The FYNSP is included in the budget justifications submitted in connection with the President's budget request.²⁰ NNSA develops the FYNSP with inputs from its subordinate offices, including the Office of Defense Programs and the Office of Defense Nuclear Nonproliferation. NNSA also describes its long-term modernization plans and budget estimates for the Weapons Activities portion of its responsibilities in its *Stockpile Stewardship and Management Plan*—a more detailed planning document on which DOE's portion of the fiscal year 2017 joint report is based—and provides information on modernization and operations plans and budget estimates over the next 25 years.²¹ The budget estimates for the first 5 years of the 25-year plan are identical to those presented in the FYNSP. For the remaining 20 years, a range of estimates is given for each of the budget components to reflect the significant uncertainties underlying the estimates, and a point estimate is also provided.²² For the purposes of this report, we refer to the point estimates as budget estimates, which represent the potential estimated costs of NNSA's nuclear modernization

²⁰NNSA refers to the cost figures included in its budget materials during the FYNSP period as "the budget" and those after the FYNSP as "budget requirement estimates." We refer to both types of cost figures as "budget estimates" throughout this report. NNSA officials stated that both sets of figures are informed by cost estimates.

²¹The *Fiscal Year 2017 Stockpile Stewardship and Management Plan* is intended as a budgetary planning guide—a strategic program of record—for the next 25 years (fiscal years 2017 through 2041).

²²NNSA estimates a range of possible costs for each component program, with the point estimate being between the high and low extremes. The basis for the cost estimates beyond the FYNSP—including the point estimates—varies depending on the individual programs or subprograms. Some portions of the programs and activities funded from the Weapons Activities appropriations account are assumed to continue beyond the FYNSP at the same level of effort as in the FYNSP. For these cost projections, NNSA used inflation escalation factors based on numbers provided by the Office of Management and Budget (OMB). For other programs and activities—the life-extension programs and major construction projects—NNSA uses either the midpoint between the range of estimates or a more robust bottom-up estimate used as the program's or project's baseline cost estimate.

program.²³ Our report also focuses on NNSA's point estimates and presents all figures as originally provided by NNSA, in nominal dollars, unless otherwise noted.²⁴

DOE's major modernization efforts are centered on life-extension programs and alterations for nuclear weapons and on major construction or refurbishment of facilities to modernize DOE's uranium and plutonium capabilities.²⁵ DOE has plans to conduct the W88 Alteration 370 and at least four life-extension programs per year simultaneously during the FYNSP period and the 5 years beyond the FYNSP period.²⁶ Construction efforts to complete DOE's Uranium Processing Facility are scheduled to be completed by fiscal year 2025; these efforts include moving uranium processing activities from a decades-old building into new facilities. Construction efforts at Los Alamos National Laboratory in support of DOE's updated plutonium strategy—which includes optimizing current infrastructure and providing additional space to support pit production—

²³According to NNSA officials, the agency gives greater preference to the cost ranges over the point estimates when referring to the potential future cost of the nuclear modernization program. However, for the purposes of our report, we refer to the point estimates, or budget estimates, when discussing the potential future cost of NNSA's nuclear modernization program.

²⁴Nominal dollars, which can also be referred to as current dollars, are valued in the prices of the current year—that is, in terms of the prices that prevail at the time (with no adjustments to remove the effects of inflation).

²⁵Life-extension programs extend, through refurbishment, the operational lives of weapons in the nuclear stockpile by 20 to 30 years and certify these weapons' military performance requirements without underground nuclear testing. Much like a nuclear weapon life-extension program, a weapon alteration replaces or refurbishes components of a weapon to ensure that the weapon can continue to meet military requirements. However, an alteration generally refurbishes fewer components than a life-extension program and does not specifically extend a weapon's operational lifetime. For the purposes of this report, we reviewed those nuclear weapons refurbishment programs under way during the 10 years covered by the joint report: the W76-1, B61-12, W80-4, Interoperable Warhead-1, and Interoperable Warhead-2 life-extension programs as well as the W88 Alteration 370.

²⁶For example, during fiscal years 2023 through 2024, NNSA will be conducting five efforts simultaneously: the W88 Alteration 370 and the B61-12, W80-4, Interoperable Warhead-1, and Interoperable Warhead-2 life-extension programs.

are also ongoing.²⁷ According to the *Fiscal Year 2017 Stockpile Stewardship and Management Plan*, DOE and DOD remain committed to achieving a production capacity of 50 to 80 pits per year by 2030.²⁸

Our Prior Reports on DOD's and DOE's Budget Estimates

Previously, we have reviewed and reported separately on the fiscal year 2014, 2015, and 2016 joint reports.²⁹ In our June 2014 report, we found that DOD's and DOE's budget estimates in the fiscal year 2014 report were generally consistent with both departments' funding and modernization plans through fiscal year 2018. However, we identified shortcomings with respect to the completeness of the budget estimates and the transparency of the assumptions and limitations that underlie the 10-year estimate and we recommended that the Secretary of Defense direct DOD components to (1) include at least a range of potential 10-year budget estimates for projects and programs, based on preliminary cost information and (2) document assumptions and limitations affecting its NC3 funding estimates. Similarly, in our July 2015 report, we found that DOD's and DOE's budget estimates in the fiscal year 2015 joint report were generally consistent with the departments' funding and modernization plans through fiscal year 2024—with a few exceptions—and that the report included information that had not been included in the fiscal year 2014 joint report. However, we again identified shortcomings in the fiscal year 2015 joint report and recommended that DOD and DOE take steps to improve the completeness and transparency of the budget estimates in future joint reports, and to provide decision makers with better information to identify significant changes from year to year. Specifically, we recommended that DOD and DOE include (1) more thorough documentation of the methodologies used to develop the budget

²⁷NNSA's Plutonium Sustainment program supports the requirements for pit production outlined in the Carl Levin and Howard P. "Buck" McKeon National Defense Authorization Act for Fiscal Year 2015 that require the Secretary of Energy, consistent with the requirements of the Secretary of Defense, to ensure that the nuclear security enterprise produces at least 10 war reserve pits in 2024, 20 war reserve pits in 2025, and 30 war reserve pits in 2026. Pub. L. No. 113-291, § 3112(b)(1) (codified at 50 U.S.C. § 2538a).

²⁸In August 2016, we reported that NNSA has determined that it needs sufficient analysis capacity to support producing pits, including at planned rates of 10 pits per year in 2024 and 50 to 80 pits per year by 2030, but an NNSA analysis shows that the revised Chemistry and Metallurgy Research Replacement project may not support these rates. See GAO, *DOE Project Management: NNSA Needs to Clarify Requirements for Its Plutonium Analysis Project at Los Alamos*, GAO-16-585 (Washington, D.C.: Aug. 9, 2016).

²⁹GAO-14-373, GAO-15-536, and GAO-16-23, respectively.

estimates and to ensure the accuracy and completeness of the information included and (2) comparative information on changes in the budget estimates from the prior year and the reasons for those changes. In December 2015, we reported on the fiscal year 2016 joint report and found that DOD's and DOE's 10-year estimates in the fiscal year 2016 report were generally consistent with the departments' funding plans through fiscal year 2020, with some exceptions, and that the joint report included information not included in the fiscal year 2015 joint report. We did not make any new recommendations in our December 2015 report.³⁰

The Joint Report's Estimates Are Generally Consistent with Both Departments' Internal Funding Plans and Long-Term Nuclear Modernization Plans, with Some Exceptions

DOD and DOE both contributed estimates for sustaining and modernizing nuclear delivery systems, the NC3 system, the nuclear stockpile, and the nuclear security enterprise to the fiscal year 2017 joint report, and these estimates are generally consistent with the two departments' internal funding plans. DOD's estimates for sustaining and modernizing nuclear delivery systems are generally consistent with its internal funding plans, although we could not fully verify DOD's budget estimates for NC3 systems. DOE's estimates for sustaining and modernizing the nuclear stockpile and nuclear security are generally consistent with its internal funding plans but may exceed projections that the fiscal year 2017 joint report identifies as the President's budget figures for the 5 years beyond the FYNSP. The difference between these DOE estimates also raises concerns about the alignment of NNSA's modernization funding needs with DOE's potential future budgets.

The Joint Report Includes Budget Estimates from Both DOD and DOE

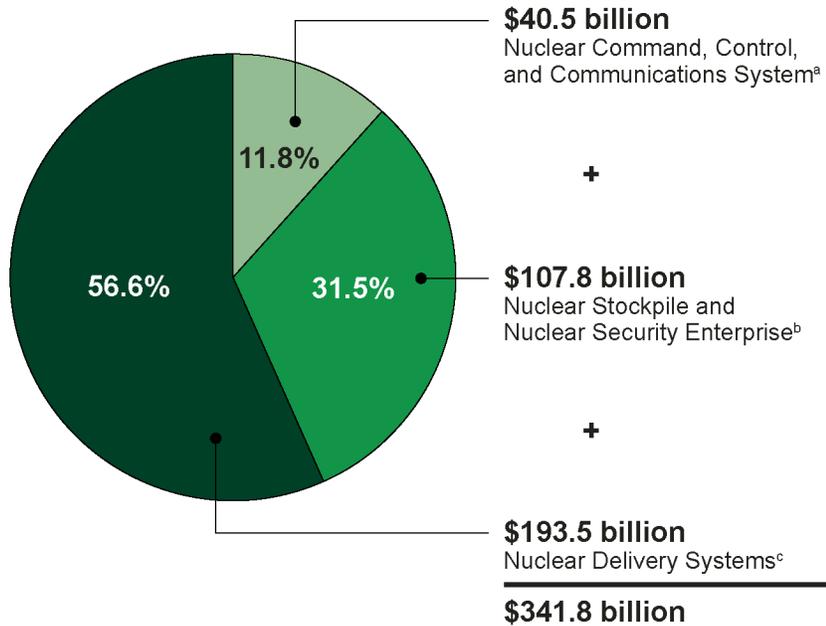
Both DOD and DOE contributed estimates for sustaining and modernizing nuclear delivery systems, the NC3 system, the nuclear stockpile, and the nuclear security enterprise for the fiscal year 2017 joint report. The fiscal year 2017 joint report estimated the 10-year budget for sustaining and modernizing U.S. nuclear weapons capabilities—including DOD's nuclear delivery systems and the NC3 system, and DOE's nuclear stockpile and the nuclear security enterprise—at \$342 billion through fiscal year 2026. DOD and DOE contributed budget estimates for sustaining and modernizing their respective areas of the nuclear enterprise. The total 10-year sustainment and modernization estimate of \$342 billion in the fiscal year 2017 joint report reflects an increase of \$22 billion over the fiscal

³⁰GAO-16-23.

year 2016 joint report's 10-year estimate of \$320 billion.³¹ DOD's estimate is approximately \$234.0 billion, or about 68.5 percent of the total. DOE's estimate is approximately \$107.8 billion, or about 31.5 percent of the total. For both DOD and DOE, more than half of their estimated funds are scheduled to be expended in the 5 years beyond the FYDP and FYNSP—fiscal years 2022 through 2026. Figure 1 shows the total 10-year sustainment and modernization estimates for the nuclear delivery systems, NC3 system, and the nuclear stockpile and nuclear security enterprise.

³¹Budget estimates in the fiscal year 2016 joint report cover fiscal years 2016 through 2025, and budget estimates in the fiscal year 2017 joint report cover fiscal years 2017 through 2026. Inflation could contribute to the difference between the 2017 projection and the 2016 projection appearing higher than it would be in the case of a comparison of the two series in real dollar values or in a comparison that looks strictly at the 9 years that overlap from each report.

Figure 1: Departments of Defense (DOD) and Energy (DOE) Fiscal Year 2017 10-Year Estimates for Sustaining and Modernizing the U.S. Nuclear Deterrent



Source: GAO analysis of Department of Defense (DOD) and Department of Energy (DOE) data. | GAO-17-557

^aDOD provides budget estimates for the nuclear command, control, and communications system, which consists of satellites, early warning radars, aircraft, communications networks, and other systems.

^bDOE provides budget estimates for the nuclear weapons stockpile, which currently consists of seven weapon types, and the nuclear security enterprise, which consists of eight geographically dispersed government-owned, contractor-operated sites, such as laboratories and test sites.

^cDOD provides budget estimates for nuclear delivery systems, which consist of a variety of platforms such as heavy bombers, air-launched cruise missiles, and ballistic missile submarines.

DOD’s Estimates for Sustaining and Modernizing Nuclear Delivery Systems Are Generally Consistent with Its Internal Funding Plans, but We Could Not Verify That NC3 Estimates Were Fully Consistent with Those Plans

In the fiscal year 2017 joint report, DOD provided budget estimates to sustain and modernize nuclear delivery systems—such as the Minuteman III missile, heavy bombers, and the *Ohio*-class submarine—and the NC3 system. DOD’s estimates for nuclear delivery systems are generally consistent with DOD’s FYDP through fiscal year 2021, but we could not verify whether the estimates for the NC3 system were fully consistent with DOD’s internal funding plans.

Nuclear Delivery System Estimates

DOD's \$193.5 billion sustainment and modernization estimate for nuclear delivery systems is comprised of estimates developed by the Air Force and the Navy for the individual systems. We found that the combined Air Force and Navy budget estimates for nuclear delivery systems are generally consistent with DOD's FYDP for specific accounts, such as procurement; research, development, test, and evaluation; operation and maintenance; and military personnel through fiscal year 2021. These estimates include the following:³²

- \$21.3 billion in procurement and military construction:
 - Air Force: \$4.5 billion,
 - Navy: \$16.8 billion;
- \$27.1 billion in research, development, test, and evaluation:
 - Air Force: \$22.5 billion,
 - Navy: \$4.6 billion; and
- \$28.2 billion in operation and maintenance and military personnel:
 - Air Force: \$15.4 billion,
 - Navy: \$12.8 billion.

DOD provides its plans for sustaining and modernizing nuclear delivery systems in a variety of documents, including the joint report, budget-justification materials, and other planning documents. These plans include maintaining current systems while developing new ones. For example:

- **Heavy Bombers.** The Air Force plans to maintain its long-range bomber capabilities through a combination of sustainment and modernization programs as well as a new bomber acquisition. Concurrently, the Air Force plans to modernize the B-2 and B-52 bombers to enable them to retain long-range strike capabilities. The B-52—a more than 50-year-old aircraft—is being modernized in areas such as communications, internal weapons bay upgrades, and replacement of various legacy systems, to keep it viable until at least 2050. For the B-2, the Air Force plans to modernize communications systems and upgrade armaments capabilities to integrate new or advanced weapons, among other areas, to extend the B-2's expected service life. The Air Force also plans to begin fielding B-21 bombers in

³²The totals for these estimates may not match totals in table 1 due to rounding.

the mid-2020s with a planned minimum fleet of 100 aircraft. This aircraft will perform both conventional missions and nuclear deterrence.

- **Air-Launched Cruise Missiles.** Because some of the air-launched cruise missile's components are expected to age-out prior to 2030, the Air Force plans to sustain these missiles until then, in part through service-life extension programs—for example, by replacing components, updating the missile's software and associated test procedures and test equipment, among other things. The Air Force has stated that the continuing need for a standoff capability makes development of a new cruise missile, the long-range standoff weapon, essential to the overall nuclear modernization effort. In fiscal year 2015, DOD delayed the long-range standoff weapon program for 3 years to attend to higher department priorities. However, according to DOD officials, for fiscal year 2016, DOD directed the Air Force to restore funding to a level that enables the program to meet U.S. Strategic Command's operational requirements and realigns Air Force efforts with the NNSA life-extension program for the W80-4 warhead. The Air Force again increased funding levels for the long-range standoff weapon in fiscal year 2017.³³
- **Ballistic Missile Submarines.** Through its *Columbia*-class submarine program, the Navy plans to design and build 12 ballistic missile submarines to replace the current force of 14 *Ohio*-class submarines.³⁴ The Navy will begin expending procurement funding in fiscal year 2017 and expects to procure the first new submarine in fiscal year 2021. In the meantime, the Navy continues to perform intermediate maintenance and industrial support for the incremental overhaul, repair, and refueling of the *Ohio*-class submarines, among other things. The Navy began a life-extension program for the Trident II submarine-launched ballistic missile so that it would remain capable throughout the life of the *Ohio*-class submarine and for the initial load-out of the *Columbia*-class submarines. The program includes replacement of the solid rocket motors and redesign and replacement of missile guidance and electronic systems, among other things.

DOD's 5-year and 10-year budget estimates for sustaining and modernizing nuclear delivery systems are summarized in table 1.

³³The U.S. Strategic Command is a combatant command responsible for developing operational plans and identifying targets for nuclear forces.

³⁴In December 2016, the Navy renamed the *Ohio*-class replacement program as the *Columbia*-class submarine program.

Table 1: Department of Defense’s (DOD) 5-Year and 10-Year Estimates for the Sustainment and Modernization of Nuclear Delivery Systems, as of August 2016

Then-year dollars in billions ^a			
Delivery system	Fiscal years 2017–2021	Fiscal years 2022–2026	10-year total
Heavy bombers			
B-2 and B-52	14.3	12.5	26.8
B-21 (formerly long-range strike bomber) ^b	12.1	26.4	38.5
B61-12 tail kit assembly	0.8	0	0.8
Cruise missiles			
Air-launched cruise missile	0.4	0.3	0.7
Long-range standoff missile	2.2	3.4	5.6
Intercontinental ballistic missile (ICBM)			
Minuteman III	7.6	6.0	13.6
Ground Based Strategic Deterrent	3.4	9.8	13.2
ICBM fuze modernization		Now included in Minuteman III	
UH-1N	1.7	1.0	2.7
Dual-capable aircraft^c	1.8	2.4	4.2
Fleet ballistic missile submarine			
<i>Ohio</i> -class submarine	9.1	8.6	17.7
<i>Columbia</i> -class submarine program ^d	13.2	30.5	43.7
<i>Columbia</i> -class submarine program reactor design (National Nuclear Security Administration)	0.6	0.3	0.9
Submarine-launched ballistic missile (Trident II)	11.9	13.2	25.1
Total^e	79.1	114.4	193.5

Source: GAO analysis of DOD data. | GAO-17-557

^aEstimated amounts include military personnel; operation and maintenance; research, development, test, and evaluation; and procurement and ship construction. DOD activities do not include overhead costs such as personnel assigned to higher headquarters who work on nuclear deterrence-related issues.

^bThe B-21 bomber is expected to perform both conventional and nuclear deterrent missions.

^cDual-capable aircraft are fighter aircraft capable of delivering nuclear weapons. These figures include operation and maintenance funding for the F-16C and F-15E squadrons based overseas and for nuclear weapons storage, as well as funds for F-35 dual-capable aircraft research, development, test, and evaluation. The 10-year projections were computed using inflation rates of 1.8 percent for the military personnel appropriations account and 2 percent for other appropriation accounts.

^dThe *Columbia*-class submarine program was formerly known as the *Ohio*-class replacement program.

^eAmounts shown may include costs for integrating nuclear command and control systems, which are also included in nuclear command, control, and communications (NC3) amounts.

NC3 System Estimates

The fiscal year 2017 joint report shows that the 5-year estimate for the NC3 system for fiscal years 2017 through 2021 totals \$20.3 billion, and the 10-year estimate for fiscal years 2017 through 2026 totals \$40.5 billion. Unlike the nuclear delivery system estimates, which are presented by program, the NC3 estimates prepared by the Office of the DOD CIO are presented in the joint report by appropriation account. The estimates for fiscal years 2017 through 2021 include

- \$4.0 billion in research, development, test, and evaluation;
- \$6.7 billion in procurement; and
- \$9.6 billion in operation and maintenance.

However, similar to what we previously reported in 2014, we could not verify whether these estimates for the NC3 system were fully consistent with DOD's internal funding plans.³⁵ The DOD CIO provided some information in the 2017 report about the methodology used to develop the NC3 budget estimates, but this information did not document all of the assumptions that were used in developing those estimates or the limitations associated with the data from which the estimates were derived. We were able to verify the calculations that DOD used to develop its estimates for research, development, test, and evaluation and for procurement, but we were not able to compare the operation and maintenance estimates with the FYDP, because the DOD CIO did not always link projects and activities with specific FYDP programs, and the supporting data that we were provided did not include calculations for the estimates for operation and maintenance funding of NC3 systems.

In our June 2014 report, we recommended that for future joint reports the Secretary of Defense direct the DOD CIO to document in the report the methodological assumptions and limitations affecting the report's estimates for sustaining and modernizing the NC3 system.³⁶ DOD agreed with our recommendation and stated that in future joint reports it would include all key assumptions and potential limitations of the methodology used to develop NC3 system estimates; however, like previous joint reports, the 2017 joint report does not provide documentation of the methodological assumptions and limitations. As a result, it was not always possible for us to determine how a given estimate was developed. We

³⁵GAO-14-373.

³⁶GAO-14-373.

discuss the limitations of the DOD CIO's methodology for developing the estimates later in this report.

DOE's Estimates for Sustaining and Modernizing the Nuclear Stockpile and Nuclear Security Enterprise Are Generally Consistent with Its Internal Funding Plans but Do Not Fully Align with Future Budgets

DOE provided estimates in the fiscal year 2017 joint report for NNSA's efforts to modernize the nuclear stockpile and nuclear security enterprise that match the modernization estimates that NNSA presents in the FYNSP and the *Fiscal Year 2017 Stockpile Stewardship and Management Plan*.³⁷ However, DOE's budget estimates in the joint report do not fully align with the agency's future budgets and long-term modernization plans over the 10-year period, raising concerns about the overall affordability of NNSA's nuclear modernization programs—that is, over the period during which NNSA's estimated funding needs may exceed projections of available resources.³⁸

In the fiscal year 2017 joint report, DOE estimated a total of about \$49.4 billion for modernization activities during fiscal years 2017 through 2021 and a total of about \$58.4 billion for fiscal years 2022 through 2026. The majority of the estimated funds are to support stockpile and infrastructure activities, which together total over \$73 billion across 10 years. DOE's 5- and 10-year budget estimates for sustaining and modernizing the nuclear stockpile and nuclear security enterprise are summarized in table 2.

³⁷NNSA developed these estimates through preparation of the FYNSP and *Fiscal Year 2017 Stockpile Stewardship and Management Plan*, which formed the basis for the \$107.8 billion budget estimates included in the report.

³⁸We discuss in greater detail these findings that cover a 25-year period (fiscal years 2017 through 2041) in an April 2017 report examining NNSA's modernization efforts as part of our annual review on whether NNSA's nuclear security budget materials provide for sufficient funding to modernize and refurbish the nuclear security enterprise. Specifically, we assessed the extent to which NNSA's budget estimates and plans for modernization activities reflected in its fiscal year 2017 nuclear security budget materials (1) differ, if at all, from its budget estimates and plans for modernization activities as presented in its fiscal year 2016 budget materials, and (2) align with NNSA's modernization plans. See GAO, *National Nuclear Security Administration: Action Needed to Address Affordability of Nuclear Modernization Programs*, GAO-17-341 (Washington, D.C.: Apr. 26, 2017).

Table 2: Department of Energy’s (DOE) 5-Year and 10-Year Budget Estimates for Nuclear Modernization, as of August 2016

Then-year dollars in billions

Category	Fiscal years 2017–2021	Fiscal years 2022–2026	10-year total
Directed Stockpile Work ^a	19.1	22.2	41.2
Research, Development, Testing, and Evaluation ^b	9.8	10.7	20.5
Infrastructure ^c	13.9	18.5	32.4
Other weapons activities ^d	6.7	7.0	13.7
Total	49.4	58.4	107.8

Source: GAO analysis of DOE data. | GAO-17-557

Note: Totals may not add due to rounding.

^aThe Directed Stockpile Work category includes DOE activities to ensure the reliability of the nuclear weapons stockpile. Among other things, this category includes the nuclear weapon life-extension programs.

^bThe Research, Development, Testing, and Evaluation category encompasses DOE activities that are technically challenging, multiyear, multifunctional efforts to develop and maintain critical science and engineering capabilities, such as capabilities that enable the annual assessment of the safety and reliability of the stockpile.

^cThe Infrastructure category includes DOE activities to operate, maintain, and refurbish infrastructure in the nuclear security enterprise, including major construction projects, such as those to modernize DOE’s uranium and plutonium capabilities.

^dOther weapons activities include budget estimates associated with nuclear weapon security and transportation as well as legacy contractor pensions, among other things, that are also included in DOE Weapons Activities.

In our April 2017 report on DOE’s *Fiscal Year 2017 Stockpile Stewardship and Management Plan*, we identified alignment and affordability concerns.³⁹ Because the DOE data presented in the joint report match the data in the FYNSP and the *Fiscal Year 2017 Stockpile Stewardship and Management Plan*, we have the same alignment and affordability concerns regarding the joint report on three levels:

- **Potential misalignment between budget and cost estimates over 10-year period:** Our analysis showed that DOE’s budget estimates may not align with cost ranges presented in its internal funding plans for several major nuclear weapons modernization programs over the

³⁹GAO-17-341.

10-year period covered by the fiscal year 2017 joint report.⁴⁰ We analyzed NNSA's budget estimates in the FYNSP and the *Fiscal Year 2017 Stockpile Stewardship and Management Plan* for these programs by comparing them against the high- and low-range cost estimates that NNSA prepared for each.⁴¹ In general, we found that, over the 10-year period covered by the joint report, the budget estimates for these major nuclear weapons modernization programs were consistent with NNSA's high- and low-range cost estimates. However, for some years, the low-range cost estimates that NNSA developed exceeded the budget estimates for some of the programs, suggesting the potential for a funding shortfall for those programs in those years. For example, we identified instances where the low-range cost estimates for the W76-1, the B61-12, the W80-4, and the Interoperable Warhead-1 life-extension programs and the W88 Alteration 370 program all exceed their budget estimates for some fiscal years within the 10-year period.⁴² As we have reported in the past, this misalignment indicates that estimated budgets may not be sufficient to fully execute program plans and that NNSA may need to increase budget estimates for those programs in the future.⁴³

Additionally, we found that the costs of some major modernization programs may increase in the future, based on NNSA information that

⁴⁰The joint report contains high-level budget estimates for activities such as Directed Stockpile Work, which includes life-extension programs and stockpile service activities, among other things. The Directed Stockpile Work category in the FYNSP and the *Fiscal Year 2017 Stockpile Stewardship and Management Plan* contains more detailed budget information for each life-extension program and major alteration, including specific budget estimates as well as high- and low-range cost estimates that NNSA developed for them. Because the joint report does not include this level of budget detail, we analyzed the budget estimates and cost range estimates for the life-extension programs and major alteration from these sources. This scope is consistent with our December 2015 review; see GAO-16-23.

⁴¹According to NNSA, the W76-1 life-extension program, which is the only weapon program that has been through the development phase and the majority of the production phase, is used as the primary basis for modeling cost ranges for all future life-extension programs. NNSA does not prepare high- and low-range cost estimates for it. NNSA officials also noted that the values in these cost ranges reflect idealized funding profiles and do not account for the actual detailed schedule of program activities, planning for risk in the project, or the results of execution to date.

⁴²We discuss these and other examples in greater detail in GAO-17-341.

⁴³GAO, *Modernizing the Nuclear Security Enterprise: NNSA's Budget Estimates Increased but May Not Align with All Anticipated Costs*, GAO-16-290 (Washington, D.C.: Mar. 4, 2016) and *Modernizing the Nuclear Security Enterprise: NNSA's Budget Estimates Do Not Fully Align with Plans*, GAO-14-45 (Washington, D.C.: Dec. 11, 2013).

was produced after the release of the fiscal year 2017 budget materials. These potential cost increases could create further inconsistencies between NNSA's budget estimates and internal cost range estimates. For example, the B61-12 life-extension program may cost \$200 million to \$2.6 billion more than the cost estimate presented in the fiscal year 2017 plan.

- **Potential budget shortfalls for fiscal years 2018 through 2021:** DOE's funding needs for certain nuclear modernization programs during fiscal years 2018 through 2021 may exceed certain out-year funding projections for that period. Specifically, according to a December 2015 letter to the Director of the Office of Management and Budget (OMB), the Secretary of Energy stated that an additional \$5.2 billion above OMB-approved funding levels would be needed for fiscal years 2018 through 2021 to establish a viable and sustainable nuclear modernization portfolio.⁴⁴ The Secretary of Energy stated that the funding level for NNSA facility infrastructure activities for fiscal years 2018 through 2021 was approximately one-half of the \$2.8 billion needed to address infrastructure issues in the future. According to the Secretary of Energy's letter, if these shortfalls were not addressed, they would fuel uncertainty in program execution, creating the potential for cost and schedule growth across the nuclear security enterprise, with the result that NNSA might not be able to sustain a viable portfolio of modernization programs.

NNSA officials we spoke with did not dispute the Secretary of Energy's statement indicating that NNSA had identified a significant gap between the level of funding believed to be necessary to address nuclear modernization requirements and the funding profile for fiscal years 2018 through 2021. These officials attributed this gap to potential discretionary spending reductions under sequestration, which was revived as a budgetary enforcement mechanism by the Budget Control Act of 2011. However, an OMB official told us that, upon review of NNSA's programs and proposed levels of funding, OMB determined that more analysis and justification was needed to support the funding levels requested for most of the programs

⁴⁴The \$5.2 billion total described above also includes some funding tied to some activities outside of NNSA's Weapons Activities appropriations account, such as for plutonium disposition and a defense nuclear nonproliferation satellite program. However, the Secretary's letter did not clearly identify all funding needs and shortfalls on a program-by-program basis. Therefore, for the purposes of our report, we include the total estimate discussed in the Secretary of Energy's letter.

identified in the Secretary of Energy's December 2015 letter. The OMB official added that funding levels for those nuclear modernization programs identified in the Secretary of Energy's letter would be reassessed in future budgets.

- **DOE estimates for fiscal years 2022 through 2026 may require significant funding increases:** According to the fiscal year 2017 joint report, DOE's budget estimates for fiscal years 2022 through 2026—the first 5 years beyond the FYNSP—may require significant funding increases over this period. For example, in fiscal year 2022, the first year beyond the FYNSP, DOE's modernization budget estimates are projected to rise significantly compared with the budget estimates for fiscal year 2021, the last year of the FYNSP. Specifically, DOE estimates that its modernization funding needs for fiscal year 2022 will be about \$11.3 billion, or about 7 percent higher than the fiscal year 2021 estimate of \$10.5 billion. Moreover, by fiscal year 2026, DOE's estimated budget totals approximately \$12.1 billion, which is about 15.3 percent higher than the fiscal year 2021 estimate.

The increase in out-year funding needs raises concerns about the affordability of DOE's nuclear modernization efforts in the 5 years beyond the FYNSP, particularly because DOE's budget estimates may exceed out-year projections for funding levels that are described in the joint report as the President's budget figures for nuclear modernization and sustainment activities over that same period. Specifically, in addition to DOE's budget estimates, the joint report included information on projected out-year funding levels described as the President's budget figures for Weapons Activities for fiscal years 2017 through 2026.⁴⁵ DOE's overall budget estimates for fiscal years 2022 through 2026 to support modernization activities total about \$58.4 billion, but the projected out-year funding levels identified as the President's budget figures included in the joint report total about \$55.5 billion during those years, which is about \$2.9 billion, or 5.2 percent,

⁴⁵The out-year projections for funding levels that are described in the joint report as the President's budget figures for fiscal years 2022 through 2026 are detailed in the fiscal year 2017 joint report. According to NNSA officials, the projected out-year funding levels identified as the President's budget figures for fiscal years 2022 through 2026 are developed using a fixed-percentage-escalated number based on the preceding year of the FYNSP, in this case fiscal year 2021.

less than DOE’s budget estimates (see table 3).⁴⁶ We identified a similar mismatch between DOE’s budget estimates and the projected out-year funding levels identified as the President’s budget figures in the fiscal year 2016 joint report.⁴⁷

Table 3: Comparison of the Department of Energy’s (DOE) Fiscal Year 2017 Weapons Activities Cost Range Estimates, Budget Estimates, and Figures Identified by DOE as Associated with the President’s Budget for Fiscal Years 2022 through 2026

Then-year dollars in billions						
	Fiscal year					Total for 2022–2026
	2022	2023	2024	2025	2026	
DOE’s fiscal year 2017 Weapons Activities cost range estimates						
High range	12.4	12.6	12.9	13.0	13.2	64.1
Low range	10.5	10.6	10.8	11.2	11.2	54.4
Fiscal year 2017 joint report						
DOE’s Weapons Activities budget estimates	11.3	11.5	11.7	11.9	12.1	58.4
President’s Weapons Activities budget figures ^a	10.7	10.9	11.1	11.3	11.5	55.5
Differences						
Amount DOE’s estimates may exceed President’s budget figures estimates	0.6	0.6	0.6	0.6	0.6	2.9
Amount the President’s budget figures estimates may exceed DOE’s low-range cost estimates	0.2	0.2	0.3	0.1	0.3	1.2

Source: GAO analysis of DOE data. | GAO-17-557

Note: Totals may not add due to rounding.

^aAccording to National Nuclear Security Administration officials, the estimates identified as the President’s budget figures for fiscal years 2022 through 2026 are developed using a fixed-percentage-escalated number based on the preceding year of the Future Years Nuclear Security Program, in this case fiscal year 2021.

⁴⁶As noted above, NNSA also provides cost ranges to describe the potential cost of its overall modernization program for those years beyond the 5 years covered by the FYNSP. Specifically, for the fiscal year 2017 joint report, the point estimate for fiscal years 2022 through 2026 totaled about \$58.4 billion, and the cost estimates ranged from a low of about \$54.4 billion to a high of about \$64.1 billion. According to NNSA officials, the agency gives greater preference to the cost ranges over the point estimates when referring to the potential future cost of the nuclear modernization program. However, for the purposes of our report, we refer to the point estimates, or budget estimates, when discussing the potential future cost of NNSA’s nuclear modernization program.

⁴⁷GAO-16-23.

The fiscal year 2017 joint report acknowledges that DOE's budget estimates for nuclear modernization may exceed the projected out-year funding levels described as the President's budget figures for fiscal year 2022 to 2026, but notes that the program of work and relative priorities for the nuclear security enterprise will be reassessed, as fiscal conditions dictate and estimates are updated, through the annual budget- and policy-formulation processes. NNSA officials also said that the estimates in the joint report for the period beyond the FYNSP do not constitute a specific budget request, nor have they been subjected to the same level of scrutiny as those in the FYNSP, in part because of the uncertainties of projecting estimates beyond the FYNSP. In addition, NNSA officials said that when evaluating whether or not its modernization plans are affordable, NNSA considers its cost range estimates and whether or not the projected out-year funding levels described as the President's budget figures for fiscal years 2022 through 2026 fall within or outside the ranges.

However, as we reported in April 2017, for the overall modernization program to be considered affordable during the fiscal years 2022 through 2026 period, NNSA's modernization programs would need to be collectively executed at the low end of their estimated cost ranges.⁴⁸ Moreover, NNSA does not utilize the projected out-year funding availability as a constraining factor when evaluating the affordability of its modernization plans. According to portfolio management standards developed by the Project Management Institute, portfolio management entails operating within the constraint of resources expected to be available in the future.⁴⁹ Furthermore, the mismatch between the estimates and the projected out-year funding levels described as the President's budget figures raises questions about the affordability of NNSA's nuclear modernization plans in the 5 years beyond the FYNSP absent either significant increases in future budgets or reductions in NNSA's estimated modernization funding needs. To help NNSA put forth more credible modernization plans, we recommended in the April 2017 report that the NNSA Administrator include an assessment of the affordability of NNSA's portfolio of modernization programs in future versions of the *Stockpile Stewardship and Management Plan*, such as by presenting options (e.g., potentially deferring the start of or canceling

⁴⁸GAO-17-341.

⁴⁹Project Management Institute, Inc., *The Standard for Portfolio Management*, Third Edition, 2013.

specific modernization programs) that NNSA could consider taking to bring its estimates of modernization funding needs into alignment with potential future budgets. NNSA neither agreed nor disagreed with our recommendation.

The Fiscal Year 2017 Joint Report Contains More Information than the Prior Fiscal Years' Reports, but Additional Information Could Improve Transparency

In the 2017 joint report, both departments describe the methodologies they used to develop their estimates for sustaining and modernizing nuclear delivery systems, the NC3 system, and the nuclear security enterprise. The fiscal year 2017 joint report also contains some information that was not included in the previous fiscal years' joint reports; however, it continues to omit explicit information regarding methodological assumptions and limitations. For example, although DOD and DOE included some comparative budget estimate data and explained why some budget estimates in the joint report had changed from those in the 2016 report, additional information identifying changes and reasons for them could improve transparency.

The Fiscal Year 2017 Joint Report Describes the Methodologies Used to Develop Budget Estimates, but the Descriptions Lack Detail, and DOD Did Not Ensure That Its Information Is Accurate

Department of Defense

The joint report states that the Air Force developed its 5-year budget estimates using program element data from the fiscal year 2017 President's budget. As in prior fiscal year joint reports, the Air Force based estimates for the 5-year period beyond the FYDP on the service's

long-range programming plans.⁵⁰ The Air Force also included in its fiscal year 2017 methodological statement additional discussion of the programs that make up each line item in its estimate, information which did not appear in the prior year's report.

However, the Air Force's methodological statement does not explain that some of those programs have been moved from the line items in which they were included in the fiscal year 2016 joint report to different line items in the fiscal year 2017 joint report. For example, UH-1N helicopter programs are given their own line item in the fiscal year 2017 joint report but these programs were included in the Minuteman III line item as "helicopter support" in the fiscal year 2016 joint report. Additionally, ICBM Fuze Modernization had its own line item in the fiscal year 2015 joint report, then was merged with the Ground Based Strategic Deterrent line item for the out-years of the fiscal year 2016 joint report, but is now folded into the Minuteman III line item in the fiscal year 2017 joint report. Some of these line-item changes are identified in the footnotes that accompany the cost estimates table and year-to-year projected changes table, but the Air Force did not identify or explain reasons for changes in the alignment of the programs, and the underlying line items, in the fiscal year 2017 joint report methodology.

The Navy documented its methodology in the joint report, stating that it developed its cost estimates using a program-element and line-item analysis of all lines devoted to the Naval Nuclear Deterrent Mission in the fiscal year 2017 President's budget minus those funds devoted to nuclear command and control. For its 10-year estimates, the Navy developed its operations and sustainment estimates using a 1.8 percent inflation factor for pay and a 2 percent inflation factor for nonpay accounts. The Navy's budget estimates for the *Columbia*-class submarine program were developed separately, taking into account factors unique to the naval shipbuilding environment, and included some additional methodological detail about this program in the fiscal year 2017 joint report's methodological information.

⁵⁰The Programmed Force Extended, a force structure and resource-allocation plan, was developed using the annual Air Force strategic planning process, which merges prior plans, current programs, adjustments in strategic and fiscal guidance, and senior-leader priorities in a constrained budget environment. The only exception is the U.S. Air Force squadron component in Europe, for which the Air Force uses a 1.8 percent inflation factor for pay and 2 percent inflation factor for nonpay accounts, because the Programmed Force Extended does not include specific planning data for major commands.

The DOD CIO's methodology for preparing its estimate for sustaining and modernizing the NC3 system through fiscal year 2026 as presented in the joint report is not fully transparent, because it lacks a discussion of the assumptions and potential limitations of the methodology. For example, the fiscal year 2017 joint report stated that DOD CIO used a "weighted analysis" to determine the portion of NC3 funding that is designated for program elements that support NC3 but also have other, nonnuclear missions. However, there is no discussion in the report of how those weighted estimates are determined. The DOD CIO used the Defense Information Systems Agency's *Nuclear Command, Control, and Communications (C3) System Program Tracking Report* from October 2011 to originally develop its methodology for selecting relevant NC3-related programs in the FYDP and to determine how much funding from each of these programs should be allocated to the NC3 mission.⁵¹ DOD CIO officials told us that they applied this methodology developed from the *Program Tracking Report* to each year's President's budget through the fiscal year 2016 joint report. However, DOD CIO officials told us that for the fiscal year 2017 joint report, they used the annual President's budget as a new baseline to identify and select which programs to include in the NC3 estimate and adjust their weightings, instead of the *Program Tracking Report*, because of the establishment of new NC3-related program elements, additional information from the Air Force, and improved visibility into NC3 program details. The officials also stated that they believe using the more current President's budget document as a baseline would make their joint report NC3 estimates more accurate each year. However, DOD CIO did not document in the joint report that they used the President's budget as a new source to select relevant NC3 programs and determine their weights, or any assumptions, limitations, or potential effects of using this different source as a baseline.

Additionally, DOD CIO calculates operation and maintenance cost estimates differently than it calculates procurement or research, development, test, and evaluation estimates, because these types of funding are planned for differently. However, the DOD CIO did not include any discussion of a need for differing methodologies in the fiscal year 2017 joint report, nor did the DOD CIO include a discussion of methodological assumptions or limitations used to develop the operation

⁵¹In our prior reports we found that the use of the Defense Information Systems Agency's report led to a key methodological limitation, because that report did not link all projects and activities with specific FYDP programs, and we found that DOD did not document that limitation and its potential effect on the NC3 estimates.

and maintenance estimate. Key principles for preparing funding plans, which we derived from several federal guidance documents, indicate that potential methodological limitations should be disclosed in order to enhance the quality of the funding plan.⁵² Further, in our 2014 report, we recommended that the Secretary of Defense direct the DOD CIO to document in future joint reports the methodological assumptions and limitations affecting the estimates.⁵³ DOD agreed with this recommendation and stated that in future reports it would include all of its key assumptions and the potential limitations of the methodologies it used in developing its NC3 system estimates; however, to date, the joint reports—including the fiscal year 2017 joint report—have not included this information.

When we discussed this issue with DOD CIO officials, they stated that they did not include this information in the joint report because the methodology is complex, the mandate does not require the additional information, and they brief congressional staff annually on their estimates and methodology. Unless explicit information on the methodologies, such as the selection of program elements in its NC3 estimate, the weighted analysis ratios, and the approaches used to calculate operation and maintenance estimates, used to develop the budget estimates is included in the joint report—including any potential limitations associated with the methodologies—it may be difficult for Congress, as it assesses long-term affordability when allocating resources, to understand the basis for the estimates and be assured of the estimates' accuracy and completeness.

Department of Energy

The fiscal year 2017 joint report provides information at a general level on how DOE's budget estimates for the FYNSP were prepared. For example, the report states that the estimates used for the FYNSP, which includes fiscal years 2017 through 2021, were generated as part of the DOE planning and programming process that informed the development of the fiscal year 2017 President's budget. The report adds that these estimates were informed in part by input from nuclear security enterprise

⁵²Such federal guidance included the following: Office of Management and Budget, *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies*; GAO-09-3SP; Office of Management and Budget, *Preparation, Submission, and Execution of the Budget*, Circular No. A-11 (Washington, D.C.: July 2013); and Office of Management and Budget, *V 3.0 Capital Programming Guide* (Washington, D.C.: July 2013).

⁵³GAO-14-373.

contractors and federal program managers and were based on both historical costs and the most current plans for programs and projects.

The joint report includes DOE budget estimates for all 10 of the years (2017 through 2026) that the report is to cover. These estimates cover different categories of activities, including the Directed Stockpile Work category, which includes the majority of funds for life-extension programs; and the Infrastructure category, which includes funds for DOE's major construction projects, such as the Uranium Processing Facility and the Chemistry and Metallurgy Research Replacement. These categories and the corresponding budget estimates are presented in the annual *Stockpile Stewardship and Management Plan* with individual line items, but DOE does not provide this level of specificity in the fiscal year 2017 joint report. For example, the joint report does not provide information on the costs of these two ongoing major construction projects, providing only some cost information in the aggregate when reporting total funding for the Infrastructure category.

The fiscal year 2017 joint report also provides a high-level description of how the budget estimation process is conducted for the life-extension programs, but it leaves out components of the methodology by which the estimate is developed. For example, the *Fiscal Year 2017 Stockpile Stewardship and Management Plan* displays, in multiple graphs, the high- and low-range cost estimates that are created as part of the process to develop life-extension program budget estimates. The 2017 joint report does not present this level of detail, nor does it provide as much detail about the budget-estimation methodology for the life-extension programs as does the *Fiscal Year 2017 Stockpile Stewardship and Management Plan*. In particular, the joint report does not detail how and when cost estimates are constructed during the different phases of the life-extension program process, and it also omits the role of subject-matter experts in the budget-estimation process. Additionally, the joint report does not discuss how it arrived at the remaining total estimated costs for the Uranium Processing Facility and the Chemistry and Metallurgy Research Replacement construction projects when discussing the overall budget line for the Infrastructure category.

The fiscal year 2017 joint report states, however, that additional information on budget requirements can be found in the *Fiscal Year 2017 Stockpile Stewardship and Management Plan* and in DOE's fiscal year 2017 Congressional budget request. For example, DOE's fiscal year 2017 congressional budget justification includes additional details about the remaining total estimated costs for the Uranium Processing Facility and

the Chemistry and Metallurgy Research Replacement construction projects. Similarly, an NNSA official previously told us that the department does not provide more detail in the joint report because additional detail is available for review in the *Stockpile Stewardship and Management Plan* and DOE's budget materials and, therefore, the level of detail that DOE currently provides in the joint report is responsive to the requirements.⁵⁴ For these reasons, we are not making a recommendation on this issue.

DOD and DOE Included Some Year-to-Year Comparison Data and Explanations, but Additional Information Could Improve Transparency and Accuracy

DOD and DOE provided year-to-year comparison of budget data as well as explanations for changes in its fiscal year 2017 joint report, but additional information on DOD and DOE's budget estimates could improve transparency and accuracy. In our July 2015 report, we recommended that DOD and DOE provide comparative information on changes in the budget estimates from the prior year and explain the reasons for those changes. In response to that recommendation, DOD included tables in the fiscal year 2017 joint report that show the changes to the budget estimates between the 2016 and the 2017 joint reports and included some explanations for these changes. However, DOD did not ensure the accuracy of this information, nor did it include all of the assumptions and limitations relevant to the year-to-year comparison tables, which may limit its utility in the fiscal year 2017 joint report. DOE did include comparison information in the joint report, which is also reported in the annual *Stockpile Stewardship and Management Plan*.

Department of Defense

DOD's 10-year estimate of \$193.5 billion for nuclear delivery systems reflects an increase of about 8.2 percent (or \$14.7 billion) over the estimate of \$178.8 billion in the fiscal year 2016 joint report. Part of the reason for the difference is that the two reports cover slightly different time frames, with the fiscal year 2017 joint report including estimates for fiscal year 2026 and excluding those for fiscal year 2016. According to the fiscal year 2017 joint report, the largest percentage change in DOD's 10-year estimate is an increase of 57.1 percent (or \$4.8 billion) over the prior year's report for the Ground Based Strategic Deterrent program. DOD attributes this increase to advancement of research, development, test, and evaluation in the FYDP and the accelerated development of launch systems and command and control elements. The largest absolute dollar change in DOD's 10-year estimate is an increase of \$8.4 billion (or 23.8 percent) in the Navy's *Columbia*-class submarine program, which DOD

⁵⁴GAO-16-23.

attributes to the program entering its initial procurement phase within the FYDP and the addition of its third submarine procurement entering the 10-year estimate window. Table 4 shows changes in DOD's 5-year and 10-year nuclear delivery system sustainment estimates.

Table 4: Changes in Department of Defense's (DOD) 5-Year and 10-Year Budget Estimates for Sustaining and Modernizing Nuclear Delivery Systems from the Fiscal Year 2016 to the Fiscal Year 2017 Joint Report

Delivery system	5-year dollar change (then-year dollars in billions)	5-Year percentage change (percent)	10-year dollar change (then-year dollars in billions)	10-year percent change (percent)
Heavy bombers				
B-2 and B-52	0.6	4.4	1.5	5.9
B-21 (formerly long-range strike bomber)	-1.8	-12.9	-3.2	-7.7
B61-12 tail kit assembly	-0.3	-27.3	-0.3	-27.3
Cruise missiles				
Air-launched cruise missile	0.0	0.0	0.0	0.0
Long-range standoff missile	0.4	22.2	0.9	19.1
Intercontinental ballistic missile (ICBM)				
Minuteman III	-0.2	-2.6	-0.5	-3.5
Ground Based Strategic Deterrent	2.5	277.8	4.8	57.1
ICBM fuze modernization	-0.8	-100.0	n/a ^a	n/a ^a
UH-1N	1.7	n/a ^b	2.7	n/a ^b
Dual-capable aircraft	0.2	12.5	1.0	31.3
Fleet ballistic missile submarine				
<i>Ohio</i> -class submarine	-0.2	-2.2	-0.8	-4.3
<i>Columbia</i> -class submarine program ^c	2.6	24.5	8.4	23.8
<i>Columbia</i> -class submarine program reactor design (National Nuclear Security Administration) ^c	-0.2	-25.0	-0.1	-10.0
Submarine-launched ballistic missile (Trident II)	0.1	0.8	0.3	1.2
Total	4.6	6.2	14.7	8.2

Source: GAO analysis of DOD data. | GAO-17-557

Notes: In the 2016 joint report, DOD inadvertently reported an incorrect figure for the B-21 (long-range strike bomber), and the budget estimates above reflect corrected data from DOD's addendum to the fiscal year 2016 joint reports. n/a = not applicable. Totals may not add due to rounding.

^aICBM Fuze Modernization had its own line item in the fiscal year 2015 joint report, was merged with the Ground Based Strategic Deterrent line item for the out-years of the fiscal year 2016 joint report, but is now folded into the Minuteman III line item in the fiscal year 2017 joint report.

^bIn previous years' joint reports, UH-1N was included as "helicopter support" in the Minuteman III line item. The fiscal year 2017 joint report is the first time it has been included as a stand-alone line item.

^cThe *Columbia*-class submarine program was formerly known as the *Ohio*-class replacement program.

DOD's 10-year estimate of \$40.5 billion for nuclear command and control systems reflects an increase of about 8 percent (or \$3.0 billion) from the estimate of \$37.5 billion in the fiscal year 2016 joint report. According to DOD CIO officials, this increase is attributable to a significant increase in research, development, test, and evaluation funding driven by investments in beyond-line-of-sight communications for various platforms, aircrew alerting system, continued development of mission planning and execution systems, cryptographic upgrades, and Navy terminal upgrades, along with recapitalization funding for the E-4 and the Airborne Launch Control System. The report also indicates that some NC3 costs may be duplicated in the delivery systems estimates as integration costs.

However, DOD did not ensure the accuracy of the information in the year-to-year projected changes table it included in the fiscal year 2017 joint report. DOD's table contains a calculation error for both the absolute change and the percent change in its 10-year estimate. In the 2017 joint report, DOD states that the 10-year estimate decreased by \$2.0 billion (or 1.0 percent). This figure in the fiscal year 2017 joint report is based on an incorrect total of \$195.5 billion that was published in the fiscal year 2016 joint report. After identifying an error in the estimate for the long-range strike bomber program (now called the B-21), DOD revised the total figure for the fiscal year 2016 estimate to \$178.8 billion in an addendum published in November 2015.⁵⁵ Table 4 contains the correct figures—an increase of \$14.7 billion (or 8.2 percent) above the fiscal year 2016 estimate total. When we brought this error to DOD's attention, DOD officials told us that they are developing an addendum to correct the error in the fiscal year 2017 joint report.

Key principles that we derived from federal budgeting and cost-estimating guidance (e.g., our *Cost Estimating and Assessment Guide*) indicate that agencies should develop a process to ensure that high-quality information

⁵⁵DOD underreported its estimated cost to sustain and modernize nuclear delivery systems in the fiscal year 2016 joint report, which served as a baseline for our analysis of the fiscal year 2017 report. Specifically, DOD reported that the 10-year estimate for the B-21 (formerly referred to as the long-range strike bomber) was \$58.4 billion, an increase of about 76 percent (approximately \$25.3 billion) over the \$33.1 billion estimate in the fiscal year 2015 report. Air Force officials explained that the estimate had been reported incorrectly as a result of an administrative error. DOD subsequently provided Congress with an addendum to the 2016 and 2015 joint reports with corrected budget estimates for the B-21 and an explanation for the error. The addendum shows that the fiscal year 2016 10-year estimate for B-21 should have been \$41.7 billion instead of \$58.4 billion. The addendum also revised the 10-year estimate for the B-21 in the fiscal year 2015 report.

is included in records they disseminate.⁵⁶ High-quality information is accurate and complete. In not ensuring the accuracy and completeness of the year-to-year comparison of estimates, DOD understated the change in estimates of the total anticipated cost of its sustainment and modernization activities. In our July 2015 report, as part of the recommendation that DOD and DOE provide more thorough documentation on the methodologies they used to develop the budget estimates, we also recommended that they ensure the accuracy and completeness of the information they include in the report. Both departments agreed with our recommendation; however, neither stated in its response what steps it would take to ensure accuracy and completeness as it develops future reports. We continue to believe it is important that the information included in the joint reports be accurate and complete and that the departments fully implement this recommendation.

Additionally, the utility of DOD's year-to-year comparison information presented in the fiscal year 2017 joint report may be limited, because the Air Force did not fully explain how assumptions and limitations in its estimate methodologies affect the comparisons for its programs. For example, in its fiscal year 2017 methodological statement, the Air Force included a discussion of the programs that make up each line item in its estimate. However, as noted previously in this report, the Air Force's methodological statement does not explain that some of those programs have been moved from the line items in which they were included in the previous year's joint report to different line items. Although this does not affect the overall total change for nuclear delivery systems or the total for the Air Force's programs, a year-to-year comparison of any single Air Force program would be misleading, because the underlying line items would be inconsistent. Some of these line-item changes are identified in the footnotes that accompany the cost estimate and projected changes tables, but the methodology statement neither identifies nor explains reasons for changes in the alignment of these programs.

According to Air Force officials, adjustments to the alignment of these programs are a byproduct of its long-term planning. Specifically, during its

⁵⁶Such federal guidance included the following: Office of Management and Budget, *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies*; GAO-09-3SP; Office of Management and Budget, *Preparation, Submission, and Execution of the Budget*, Circular No. A-11 (Washington, D.C.: July 2013); and Office of Management and Budget, *V 3.0 Capital Programming Guide* (Washington, D.C.: July 2013).

annual budget and planning process, the Air Force may make adjustments to the way it groups program elements to better align program elements with long-term plans, according to Air Force officials. These adjustments changed the program elements that are associated with particular nuclear delivery system programs presented in the fiscal year 2017 joint report. For example, “helicopter support” was pulled out of the Minuteman III line item and given its own—the UH-1N line item—in the fiscal year 2017 joint report because, according to Air Force officials, the program had matured to the point that it was large enough to stand on its own. In response to our inquiries, Air Force officials acknowledged that direct comparisons of individual programs from one year to the next are complicated by these annual adjustments. The officials also acknowledged that, although the year-to-year comparisons of specific Air Force program line items in the joint report may be misleading because they may not include the same underlying elements, the broader Air Force program categories would be accurate. Without the Air Force identifying any programmatic changes (e.g., movement of programs from one line item to another appearing in the joint report) in its estimates, the explanation of those changes, and the effect of those changes on year-to-year comparisons of the estimates, Congress may have difficulty understanding the basis for the estimates or comparing estimates across fiscal years.

Department of Energy

DOE’s portion of the fiscal year 2017 joint report provides information about why the estimates for certain programs changed from the fiscal year 2016 joint report. Specifically, the fiscal year 2017 joint report provides descriptive examples of how the estimates for certain programs increased from the prior year’s report, such as the W88 Alteration 370 and the W80-4 life-extension program. For example, the joint report states that the overall estimates for the W88 Alteration 370 and the W80-4 life-extension program experienced a moderate increase because of additional scope of work. The fiscal year 2017 joint report also notes that the estimates for other programs decreased. In particular, the joint report states that the estimated costs for the three Interoperable Warhead life-extension programs decreased because a shared component was reevaluated and found to be much simpler and less expensive than in last year’s report. NNSA similarly describes these and other changes in the *Fiscal Year 2017 Stockpile Stewardship and Management Plan*, the more detailed annual planning document on which DOE’s portion of the 2017 joint report is based.

However, the fiscal year 2017 joint report does not include comparative information that explains the changes in estimates for the categories of

Weapons Activities presented in the plans. Our review of the fiscal year 2016 and 2017 joint reports found that DOE’s estimate of \$107.8 billion for its nuclear modernization efforts reflects an increase of about 4.1 percent (or \$4.3 billion) over the estimate of \$103.5 billion in the fiscal year 2016 joint report. Part of the reason for the difference is that the two reports cover slightly different time frames, with the fiscal year 2017 joint report including estimates for fiscal year 2026 and excluding those for fiscal year 2016. Table 5 shows the changes in budget estimates from the fiscal year 2016 joint report to the 2017 joint report in DOE’s 5-year and 10-year estimates for modernizing the nuclear stockpile and the nuclear security enterprise.

Table 5: Changes in the Department of Energy’s (DOE) 5-Year and 10-Year Budget Estimates for Sustaining and Modernizing the Nuclear Stockpile from the Fiscal Year 2016 to the Fiscal Year 2017 Joint Report

Category	5-year dollar change (then-year dollars in billions)	5-year percentage change (percent)	10-year dollar change (then-year dollars in billions)	10-year percentage change (percent)
Directed Stockpile Work	1.5	8.6	1.8	4.6
Research, Development, Testing, and Evaluation	0.4	3.8	0.5	2.3
Infrastructure	0.2	1.2	1.5	4.8
Other weapons activities	0.2	3.2	0.5	3.9
Total	2.2	4.8	4.3	4.1

Source: GAO analysis of DOE data. | GAO-17-557

Notes: Totals may not add due to rounding. Moreover, inflation could make the difference between the 2017 projection and the 2016 projection appear higher than it would be in the case of a comparison of the two series in real dollar values or in a comparison that looks strictly at the 9 years that overlap from each report.

Moreover, according to our analysis of the data underlying DOE’s budget estimates, additional differences between the fiscal year 2016 and 2017 joint reports are due to an increase in the budget estimates for some individual programs. For example, the 10-year estimates for some life-extension programs increased from the 2016 joint report to the 2017 joint report as a result of an additional out-year included in the estimates. In addition, certain program changes led to differences between the two reports. For example, as noted in the *Fiscal Year 2017 Stockpile Stewardship and Management Plan*, the Nuclear Material Commodities program was renamed the Strategic Materials program and incorporated a new line item that consolidated storage and material recovery and recycling, two programs that had previously been included in the infrastructure category. As a result of this change, the 10-year estimate

for the Strategic Materials program increased by about \$2.3 billion. The increases and changes to these individual programs, in turn, contributed to the increase in the budget estimates for Directed Stockpile Work in the 2017 joint report. According to NNSA officials, the information provided in the joint report reasonably captures the changes in both the estimates and in its modernization program and NNSA would provide more comparative information on significant changes to the budget estimates from the previous year, when warranted. Because additional information on year-to-year changes to NNSA's budget estimates and modernization program is available in other publicly available documents, such as the *Stockpile Stewardship and Management Plan*, we are not making a recommendation on this issue.

Conclusions

Sustaining and modernizing the U.S. nuclear stockpile (including delivery systems), the nuclear security enterprise, and the NC3 system is a long-term, multifaceted effort expected to cost about \$342 billion over the next 10 years. The annual DOD and DOE joint report is one means by which Congress gathers the information it needs to understand the administration's plans to invest in nuclear deterrence capabilities over the long term. Each year the report provides information on sustainment and modernization costs, which can change. In order to assess the affordability of these efforts, it is important that Congress have complete and transparent budget estimates. The fiscal year 2017 joint report's sustainment and modernization estimates are generally consistent—with some exceptions—with the departments' internal funding plans, and DOD has included additional information in the current joint report that was not included in the previous year's report. However, the usefulness and transparency of the joint report could be further improved if DOD explicitly identified and explained all methodological assumptions and limitations affecting the NC3 system estimate and included additional information to clarify assumptions and limitations for its year-to-year comparisons, particularly regarding changes in the alignment of the Air Force's programs. Unless DOD provides more explicit documentation of the methodology it used to develop the NC3 budget estimate—such as identifying the process for (1) selecting program elements for its NC3 estimate; (2) determining its weighted analysis ratios; and (3) differentiating its methodology for calculating operation and maintenance estimates from the methodologies for calculating estimates for the other NC3 line items—and more complete comparative information on any changes in the budget estimates to Air Force programs from the prior year—including the reasons for those changes—Congress may have difficulty understanding the basis for the estimates or comparing

estimates across fiscal years. Moreover, decision makers might not be fully aware of developing trends and potential risks that they would need to consider in making funding decisions and developing effective risk-mitigation strategies. We also had concerns about the overall affordability of DOE's nuclear modernization programs and made recommendations to address them in our April 2017 report.⁵⁷

Recommendations for Executive Action

As DOD continues to improve the completeness and transparency of subsequent joint reports' methodologies in order to assist Congress in understanding the basis of the NC3 estimates by documenting the methodological assumptions and limitations affecting the report's estimates for sustaining and modernizing the NC3 system, as we previously recommended, we further recommend that for future joint reports, the DOD CIO include explanations of how DOD

- selects program elements for inclusion in its NC3 estimate,
- determines its weighted analysis ratios, and
- differentiates its methodology for calculating operation and maintenance estimates from its methodologies for calculating estimates for the other NC3 line items.

In order to assist Congress in comparing year-to-year cost estimates between joint reports, we recommend that, for future joint reports, the Secretary of the Air Force provide information about any programmatic changes (i.e., programs being moved from one line item to another) in its estimates and include an explanation of the reasons for those changes and how those changes may affect year-to-year comparisons of the budget estimates.

We are not making recommendations to the Secretary of Energy in this report because we previously recommended that NNSA address concerns about the overall affordability of the agency's nuclear modernization programs by including an affordability assessment in future versions of the *Stockpile Stewardship and Management Plan*.

⁵⁷GAO-17-341.

Agency Comments and Our Evaluation

We provided a draft of this product to DOD and DOE for comment. In response, we received written comments from DOD, which are reprinted in appendix II. DOE did not provide a formal response, because the report made no recommendations to NNSA. Both departments provided technical comments, which we incorporated as appropriate.

DOD concurred with both of our recommendations, stating that it has incorporated them into the fiscal year 2018 joint report. In response to our first recommendation, DOD also said that subsequent joint reports will provide updated methodological inputs, assumptions and limitations affecting NC3 estimates. In response to our second recommendation, DOD said that subsequent reports will continue to provide the recommended information but also will be revised as necessary to ensure a complete and transparent statement on programmatic changes and their possible effect on year-to-year comparisons of budget estimates. We are encouraged that DOD is taking these actions and continue to believe that, if DOD implements these actions as described, it will be further improving the usefulness and transparency of the joint report and assisting Congress's efforts to understand the administration's plans to invest in nuclear deterrence capabilities over the long term.

We are sending this report to the appropriate congressional committees and to the Secretaries of Defense and Energy; Chairman, Joint Chiefs of Staff; Secretary of the Air Force; Secretary of the Navy; and Administrator of NNSA. This report is also available at no charge on the GAO website at <http://www.gao.gov>.

Should you or your staffs have any questions about this report, please contact Joe Kirschbaum at (202) 512-9971 or kirschbaumj@gao.gov, or David Trimble at (202) 512-3841 or trimbled@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made contributions to the report are listed in appendix III.

A handwritten signature in black ink that reads "Joe W. Kirschbaum" with a long horizontal stroke extending to the right from the end of the name.

Joseph W. Kirschbaum
Director, Defense Capabilities and Management

A handwritten signature in black ink that reads "David C. Trimble" in a cursive style.

David C. Trimble
Director, Natural Resources and Environment

List of Committees

The Honorable John McCain
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The Honorable Jack Reed
Ranking Member
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The Honorable Marcy Kaptur

Ranking Member
Subcommittee on Energy and Water Development and Related Agencies
Committee on Appropriations
House of Representatives

Appendix I: Objectives, Scope, and Methodology

To conduct our work, we reviewed the August 5, 2016, joint report to Congress from the Department of Defense (DOD) and the Department of Energy (DOE). The joint report describes the departments' plans and 10-year budget estimates for sustaining and modernizing U.S. nuclear weapons capabilities. Section 1043 of the National Defense Authorization Act for Fiscal Year 2012, as amended, includes a provision for us to review each joint report for accuracy and completeness with respect to the budget estimates and the methodologies used to develop them.¹

We assessed the extent to which the joint report provides (1) budget estimates for nuclear weapons sustainment and modernization that are consistent with DOD's and DOE's internal funding plans and long-term nuclear modernization plans and (2) complete and transparent information on the methodology used to develop these budget estimates.² To address our objectives, we followed a methodology similar to the one we used during our review of prior fiscal years' joint reports.³ We assessed the accuracy and completeness of the budget estimates in the report by determining whether they were consistent with the departments' internal funding plans and whether the report provides complete information and includes a transparent methodology for how the estimates were developed. We examined the departments' plans and budget estimates for sustaining and modernizing the nuclear deterrent in three areas: (1) DOD nuclear delivery systems, (2) the DOD nuclear command, control, and communications (NC3) system, and (3) DOE nuclear weapons and the nuclear security enterprise.

To determine the extent to which the budget estimates in the fiscal year 2017 joint report are consistent (accurate and complete) with DOD's and

¹See Pub. L. No. 112-81, § 1043(c) (as amended).

²For the purpose of this report, we use the term "long-term" to refer to DOD and DOE plans that go beyond the 5-year period of the Future Years Defense Program (FYDP) and the Future Years Nuclear Security Program (FYNSP) (in this case, beyond fiscal year 2021).

³We previously reported on the fiscal year 2014 joint report in June 2014, the fiscal year 2015 joint report in July 2015 and the fiscal year 2016 report in December 2015. GAO, *Nuclear Weapons: Ten-Year Budget Estimates for Modernization Omit Key Efforts, and Assumptions and Limitations Are Not Fully Transparent*, GAO-14-373 (Washington, D.C.: June 10, 2014); *Nuclear Weapons Sustainment: Improvements Made to Budget Estimates, but Opportunities Exist to Further Enhance Transparency*, GAO-15-536 (Washington, D.C.: July 30, 2015); and *Nuclear Weapons Sustainment: Improvements Made to Budget Estimates Report, but Opportunities Remain to Further Enhance Transparency*, GAO-16-23 (Washington, D.C.: Dec. 10, 2015).

DOE's internal funding and long-term modernization plans, we compared the plans and estimates in the 2017 joint report with each department's funding plans. For our review of DOD's estimates for nuclear delivery systems and the NC3 system, we compared the estimates in the fiscal year 2017 joint report with funding plans in the Future Years Defense Program (FYDP).⁴ Because DOD had not prepared internal funding plans beyond fiscal year 2021 to be used to project estimated budget requests, and the fiscal year 2017 joint report includes budget estimates through fiscal year 2026, we reviewed DOD plans for Air Force delivery systems, Navy plans for its delivery systems, and Defense Information Systems Agency plans—including the *Nuclear Command, Control, and Communications (C3) Program Tracking Report*—and we discussed DOD's long-term budget estimates in the joint report with relevant DOD officials. At DOD, we met with officials from a range of offices responsible for developing the department's contributions to the joint report. In addition to the Air Force, Navy, and Department of Defense Chief Information Officer (DOD CIO), we met with officials from the Office of the Under Secretary of Defense (Policy); Office of the Under Secretary of Defense (Comptroller); Director of Cost Assessment and Program Evaluation; and U.S. Strategic Command.

For our review of DOE's plans and estimates, we compared DOE's estimates in the joint report with National Nuclear Security Administration's (NNSA) funding plans in the Future Years Nuclear Security Program (FYNSP) and the *Fiscal Year 2017 Stockpile Stewardship and Management Plan*, which includes estimated funding requirements for NNSA's modernization plans that cover the time required for the joint report and beyond.⁵ Specifically, for the purposes of this report, we compared the fiscal years 2017 through 2026 period from the 2017 plan with the fiscal years 2016 through 2025 period from the 2016 plan. Comparing the activities and budget estimates intended to

⁴The FYDP is a centralized DOD report that is updated annually and provides DOD's current budget request and budget estimates for at least 4 subsequent fiscal years. The FYDP includes thousands of discrete program elements, each of which may include funding projections for DOD appropriations accounts, including research, development, test, and evaluation; procurement; and operation and maintenance.

⁵Department of Energy, *Fiscal Year 2017 Stockpile Stewardship and Management Plan Report to Congress* (Washington, D.C.: March 2016). The *Stockpile Stewardship and Management Plan* is NNSA's formal means for communicating to Congress the status of certain activities and its long-range plans and budget estimates for sustaining the stockpile and modernizing the nuclear security enterprise. The *Stockpile Stewardship and Management Plan* includes 25-year budget estimates for NNSA's plans.

support these activities across the 10-year periods in the different plans provides insights for budgeting planning purposes as to how NNSA's nuclear security budget materials have changed from one plan to the next.⁶ We determined the estimates in the fiscal year 2017 joint report to be sufficiently accurate and complete if they were consistent with the departments' funding plans, including the FYDP and FYNSP.⁷ We have previously reported on DOD's and DOE's challenges in generating reliable budget estimates and programming data.⁸

To assess whether the fiscal year 2017 joint report includes complete and transparent information from DOD and DOE for nuclear sustainment and modernization budget estimates, we drew on work we performed for our review of the prior fiscal years' joint reports.⁹ At DOD, we obtained Air Force, Navy, and DOD CIO documentation of the methodologies they used to develop DOD's 10-year estimates for sustaining and modernizing nuclear delivery systems and the NC3 system. For DOE, we drew upon our current work reviewing the *Fiscal Year 2017 Stockpile Stewardship and Management Plan* to assess estimates in the joint report for sustaining and modernizing the nuclear security enterprise and nuclear

⁶The basis for the cost estimates beyond the FYNSP—including the point estimates—varies depending on the individual programs or subprograms. Some portions of the programs and activities funded from the Weapons Activities appropriations account are assumed to continue beyond the FYNSP at the same level of effort as in the FYNSP. For these cost projections, NNSA used inflation escalation factors based on numbers provided by the Office of Management and Budget (OMB). For other programs and activities—the life-extension programs and major construction projects—NNSA uses either the midpoint between the range of estimates or a more robust bottom-up estimate used as the program's or project's baseline cost estimate.

⁷We did not assess the overall reliability of DOD's and DOE's internal funding plans themselves or the departments' underlying budget-estimating process, because such analysis exceeded the scope of the mandate. We also did not independently verify the reliability of DOD's or DOE's specific budget estimates.

⁸GAO, *Department of Energy: Observations on Project and Program Cost Estimating in NNSA and the Office of Environmental Management*, GAO-13-510T (Washington, D.C.: May 8, 2013); *Modernizing the Nuclear Security Enterprise: NNSA's Reviews of Budget Estimates and Decisions on Resource Trade-offs Need Strengthening*, GAO-12-806 (Washington, D.C.: July 31, 2012); *DOD Weapon Systems: Missed Trade-off Opportunities During Requirements Reviews*, GAO-11-502 (Washington, D.C.: June 16, 2011); *Modernizing the Nuclear Security Enterprise: NNSA Increased Its Budget Estimates, But Estimates for Key Stockpile and Infrastructure Programs Need Improvement*, GAO-15-499 (Washington, D.C.: Aug. 6, 2015); *National Nuclear Security Administration: Action Needed to Address Affordability of Nuclear Modernization Programs*, GAO-17-341 (Washington, D.C.: Apr. 26, 2017).

⁹GAO-14-373, GAO-15-536, and GAO-16-23.

weapons stockpile.¹⁰ We also asked NNSA officials for information on how the joint report was prepared.

We then compared the information in the joint report with key principles for developing and preparing long-term funding plans that we derived for our 2014 report by reviewing key federal and departmental guidance, standards, and practices for cost estimating, budget preparation, financial planning, and public reporting. Such federal guidance included Circular No. A-11, *Preparation, Submission, and Execution of the Budget*,¹¹ *Capital Programming Guide Version 3.0*,¹² and *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by Federal Agencies*,¹³ all published by the Office of Management and Budget, as well as the GAO *Cost Estimating and Assessment Guide*.¹⁴ To the extent that we determined there were differences between the principles we derived and information that was provided in the fiscal year 2017 joint report, we discussed the causes and potential effects of these differences with relevant DOD and DOE officials. At DOD, we met with officials from the Air Force; Navy; DOD CIO; Office of the Under Secretary of Defense (Policy); Office of the Under Secretary of Defense (Comptroller); Director of Cost Assessment and Program Evaluation; and U.S. Strategic Command. At DOE, we met with officials in the Office of Defense Programs.

To evaluate DOD's and DOE's year-to-year comparisons of budget estimates and the explanations for changes in the fiscal year 2017 joint report, we compared the estimates in the fiscal year 2017 joint report to the estimates in the fiscal year 2016 joint report. We then compared our

¹⁰GAO-17-341.

¹¹Executive Office of the President, Office of Management and Budget, *Preparation, Submission, and Execution of the Budget*, Circular No. A-11 (Washington, D.C.: July 2013).

¹²Executive Office of the President, Office of Management and Budget, *V 3.0 Capital Programming Guide: Supplement to Circular No. A-11: Planning, Budgeting, and Acquisition of Capital Assets* (Washington, D.C.: July 2013).

¹³Executive Office of the President, Office of Management and Budget, *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies*, accessed August 14, 2013, http://www.whitehouse.gov/omb/fedreg_final_information_quality_guidelines.

¹⁴GAO, *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*, GAO-09-3SP (Washington, D.C.: Mar. 2, 2009).

change calculations against the comparisons DOD and DOE presented in the fiscal year 2017 joint report. Where we identified potential errors, we discussed the causes of those errors with relevant agency officials.

We conducted this performance audit from May 2016 to July 2017 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: Comments from the Department of Defense



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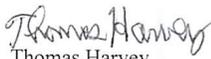
JUN 23 2017

Mr. Joseph Kirschbaum
Director, Defense Capabilities Management
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Mr. Kirschbaum:

This is the Department of Defense response to the GAO Draft Report, GAO-17-557, "NUCLEAR WEAPONS SUSTAINMENT: Budget Estimates Report Contains More Information than in Prior Fiscal Years, but Transparency Can Be Improved," dated May 10, 2017 (GAO Code 100856).

Enclosed the Department provides its formal response to the GAO's recommendations. Thank you for your review and consideration.


Thomas Harvey
Acting

Enclosure:
TAB A: DoD Response to GAO Recommendation

GAO DRAFT REPORT DATED MAY 9, 2017
GAO-17-557 (GAO CODE 100856)

“NUCLEAR WEAPONS SUSTAINMENT: BUDGET ESTIMATES REPORT
CONTAINS MORE INFORMATION THAN IN PRIOR FISCAL YEARS, BUT
TRANSPARENCY CAN BE IMPROVED”

DEPARTMENT OF DEFENSE COMMENTS
TO THE GAO RECOMMENDATION

RECOMMENDATION 1: The GAO recommends that as DoD continues to improve the completeness and transparency of subsequent joint reports methodologies in order to assist Congress in understanding the basis of the NC3 estimates by documenting the methodological assumptions and limitations affecting the report's estimates for sustaining and modernizing the NC3 system, as GAO previously recommended, GAO further recommend that for future joint reports, the DoD CIO include, explanations of how DoD

selects program elements for inclusion in its NC3 estimate,

determines its weighted analysis ratios, and

differentiates its methodology for calculating operation and maintenance estimates from its methodologies for calculating estimates for the other NC3 line items.

DoD RESPONSE: DoD concurs with the GAO recommendation stated above. The Department has incorporated the above recommendation into the FY 2018 report and supplied a methodology that explains how programs are selected, basis for the weighting, and legally-compliant operations and maintenance expenditure reporting. Subsequent reports will provide updated methodological inputs, assumptions and limitations affecting NC3 estimates.

RECOMMENDATION 2: The GAO recommends that for future joint reports, the Secretary of the Air Force provide information about any programmatic changes (i.e., programs being moved from one line item to another) in its estimates and include an explanation of the reasons for those changes and how those changes may affect year-to-year comparisons of the budget estimates.

DoD RESPONSE: DoD concurs with the GAO recommendation stated above. The Department has incorporated the above recommendation into the FY 2018 report. Subsequent reports will continue to provide recommended information and will be revised as necessary to ensure a complete and transparent statement on programmatic changes and their possible effect on year-to-year comparisons of budget estimates.

Appendix III: GAO Contacts and Staff Acknowledgments

GAO Contacts

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David C. Trimble, (202) 512-3841 or trimbled@gao.gov

Staff Acknowledgments

In addition to the contacts named above, Penney Harwell Caramia, Assistant Director; William Hoehn, Assistant Director; Steve Boyles, Neil Feldman, Joanne Landesman, Amie Lesser, Steven Putansu, Kevin Remondini, Michael Shaughnessy, and Kevin Tarmann made key contributions to this report.

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